EFFECT OF HYDROGEN SORPTION ON SURFACE MORPHOLOGY OF PYROLYTIC GRAPHITE

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Graphite materials have a wide range of application from fusion devices to nanotubes for hydrogen storage. For a solution of applied problems it is necessary to know various properties of graphite, among them the mechanism of interaction with hydrogen and effect of hydrogen on surface structure and bulk properties of graphite are of particular interest.

The most part of peculiarities of graphite arises from its crystallographic structure. An idealized graphite crystal consists of plane graphene layers stacked along c-axis and held together by weak van der Waals forces. The last allows to consider graphite crystal as a number of weekly bonded two dimensional layers. It is the layered structure that governs the main features of graphite interaction with foreign particles and leads to the formation of graphite intercalation compounds.

Interaction of the ordered pyrolytic graphite with atomic hydrogen was studied by means of atomic force (AFM) and scanning tunnel (STM) microscopy, and thermal programmed desorption (TPD) spectroscopy. After irradiation of the samples with atomic hydrogen AFM and STM images of initially atomically flat surface reveal the «hill-like» (or «bubbled») structure. The height of bubbles was about 3-5nm and their lateral size ~45-70nm. This «hill-like» structure was not due to the formation of an amorphous αC-H film observed in the course of graphite sputtering in hydrogen: STM images with atomic resolution indicate the ordered graphite structure of the surfaces with a «hill-like» morphology.

After hydrogen desorption a number of etch pits mainly one monolayer deep could be observed at the sample surface. All etch pits have a near circular geometry. The average density of etch pits correlates well with the small amount of hydrocarbons released in the course of TPD. No changes of the surface morphology were observed for the back surface of the samples.

All the obtained results are consistently accounted for within the framework of intercalation model.